ORNITHOPHILOUS POLLINATION.

By Joseph L. Hancock.

The position that some of the humming-birds occupy in respect to the transference of pollen from flower to flower is by no means subordinate to insects.[1]

The common ruby-throated humming-bird (*Trochilus colubris*) though not endowed with specialized structures for the specific performanee of this office, bears upon careful study evidence that the mouth parts and feathers have certain means for the harboring of pollen quite beyond the ordinary views. The anatomical peculiarities of this bird's head allows access to flowers, covering a wide range of forms. A narrowing awl-shaped cone 29 mm. long represented by a base of 10 mm. admits of this latitude, as expressed more clearly in the accompanying plate, figures 2 and 3, of the head and skull. By reason of some flexibility, the bill is capable of probing to the bottom of nearly all the forms of flowers commonly met with. In the feeding process, familiar to almost every one, the flower is often bent over to be relieved of its juices. The trumpet honeysuckle (*Lonicera sempervirens*) in the proper season, furnishes an important part of the food of *T. colubris*. This vine appears wild in the south, the corolla of the flower is long, see figure 6, red and scentless. There is a way of accounting for this latter condition. Fragrant odors are largely essential to the attraction of bees and other insects, but as this plant does not lean upon their aid for fertilization, but depends more upon the humming-bird and larger moths for the interchange of pollen, the absence of fragrance is accounted for. The two last mentioned, from my own observations, depend for the most part upon sight for the detection of food plants. A male specimen of the ruby-throated humming-bird which was taken from a cat which had seized it in the act of feeding upon the nectar of flowers, was sent to the writer by a friend. From

[1]To this power in birds the designation of *ornithophilous* pollination is proposed in contradistinction to *entomophilous* pollination.

this and other dead specimens was derived much of the present knowledge. A cursory examination with the naked eye of the head does not reveal with clear distinctness the important facts brought out by the use of the microscope, consequently this instrument was brought into use in furthering research. Pollen is carried in several ways by this bird. On the lower mandible just in front of the angle of the mouth, overshadowed by the nasal scale when the bill is closed, a faint yellowish line marks the deposit of pollen grains resting in a small groove clustered together, see figure 5 at point b. Here were found various kinds, but one small form rather irregularly round in outline predominated. Pollen-grains work their way free to the summit or vanes of the feathers about where they were seen scattered, and as will be described further on, caught up by the barbs of the feathers, along the sides of the chin and lores ready to be deposited when a more suitable surface presents. Under the lower bill, see enlarged view, figure 4, and also 5a, the deep median groove, the point of meeting of the rami, which traverses along for nearly one-half its length, acts as a second repository. This pollen repository groove becomes divided backwards on either side for a short distance. Pollen lodges in larger quantities here and can be detected deep within the median portion of the groove. It is interesting to note that pollen found deep in the recess of this part bore evidence of greater age and possibly from foreign plants unknown to me. This fact opens up a line of investigation which promises interesting results in the future. With a needle the mass of grains which cluster together can be removed and separated with care. A small mass, only a fractional part of what still remained, showed with a focus of a $\frac{1}{4}$ inch objective hundreds of pollen-grains. The long shaft of the bill also had upon its surface a few scattered ones. The most noteworthy phase of this subject remains yet to be recorded when the feathers are analyzed in greater detail, for here is to be found the real means of scattering the pollen or pollination. The chief *repositories* having been just described as occurring below the angle of the mouth and in the median

groove under the lower mandible, it remains to mention the part taken by the feathers.

There are four ways by which the pollen becomes engaged or held by the feathers, which will be better understood after the anatomy of the latter structures are touched upon. The feathers from the sides of the head, lores and below, are mainly instrumental in this work. In general they are much like feathers of other birds, of the contour type, plumulaceous at the base, composed of a short, weak calamus, a rhachis, vanes, barbs and barbules; the latter being peculiar in that at the extremity of the vane the barbules are armed with sharp, thistle-like projections (barbicels) some of which are somewhat curved. The vanes at the base of the feathers are long and thread-like, near where they join the shaft are flattened oar fashion as seen in figure 8. Little pointed barbs divide these filimentous vanes at regular short distances. One of the methods of carrying pollen is here met with between two of the vanes as shown. The vanes of the upper part of the main body of the feather, are made up of narrow acute plates or barbs resting close together. The barbs of another vane often encroach or touch the barbs of a neighboring vane, so that between them is found entrapped many pollen-grains as demonstrated in figure 7. Another way by which pollen is effectually engaged is between two of the barbs merely spread apart, giving room for the grain to be held as in figure 9. The fourth method observed of carrying these fertilizing agents is an extraneous one, depending upon the glutinous secretion from the stigma of plants that adhere to the feathers, thus assisting the pollen to stick fast to the feather. Through a high magnifying power is seen the thistle-like ending of the vanes, the barbules frequently matted together by the sticky secretion referred to, gathered from the flowers while in search of food. Attached to the many pointed and flattened surfaces were seen pollen-grains of many kinds, chiefly of very minnte size, ready to depart or taken on anew at the next visit to a flower. In anemophilous flowers in which the wind is the agency for carrying the pollen, the grains are usually small, light, more or less dry and spherical, while in entomophilous

flowers, the pollen of which is carried from one plant to another by insects in search of honey, are variously adapted to cause the grains to adhere to the hairy underside of the insects body to promote their dispersion. In ornithophilous pollination the pollen is carried in such diverse ways that this together with other data combine to make it possible that the humming-bird is the most wonderful distributor of pollen known to the animal world. We are not content to leave the subject without noticing, that as compared with insects, the local range of flight of humming-birds is undoubtedly greater and during the regular migrations they make extensive flights.[2] Their summer home in eastern North America extends from the Gulf of Mexico to half way across the British Provinces and from the Atlantic Coast to beyond the Mississippi River. In winter its range is southward, reaching into Southern Florida, into Veragua and the western portion of the Isthmus of Panama, about eight degrees north of the equator. The equivalent of some 2000 statute miles is thus represented in the migrations of this diminutive bird. The pollen taken enroute during migration, as the humming-bird takes its sip of nectar from flower to flower, may gather in its repositories and be transported from place to place anywhere throughout its range. That some strange pollen grains are found entangled upon the bird is not surprising, especially in spring, taking these suggestions into consideration, and what wonder is it we are called upon to say that the phenomena of so widespread and perpetual a means of pollination of plants is perhaps unparalleled.

Explanation of Plate.

Fig. 1. *Trochilus colubris* taking food, drawn from memory.
Fig. 2. Head of *T. colubris* from nature.
Fig. 3. Skin removed from head to show skull.

[2]It will be observed that the author refers entirely to the ruby-throated humming-bird (*T. colubris*) here, and what may be brought out by a further study of other species as regards to the part they play in pollination is a matter for the future.

PLATE XXII.

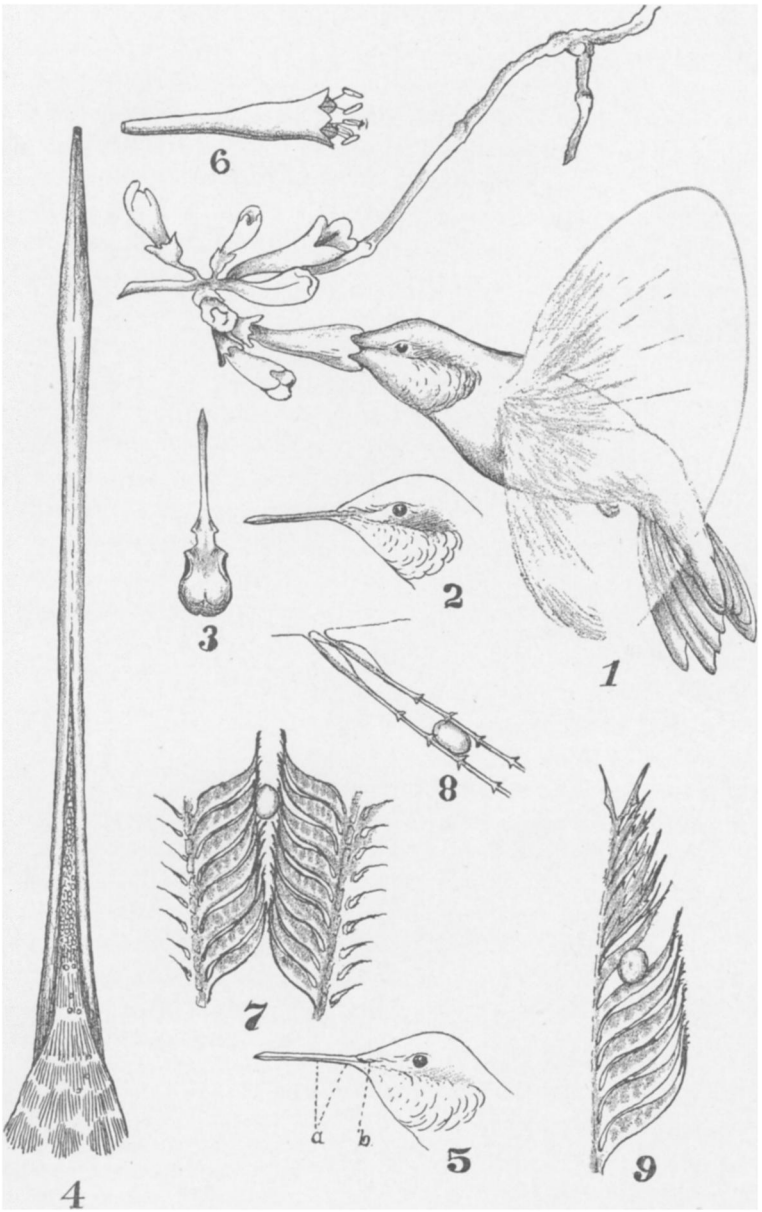

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Fig. 4. Enlarged ventral view of lower mandible showing pollen repository groove.

Fig. 5. Head of *T. colubris* showing *a*, side repository, *b*, repository under the lower mandible.

Fig. 6. Single flower of Trumpet Honeysuckle.

Fig. 7. Two vanes side by side, *from main part* of a feather of *T. colubris*, showing one of the ways of carrying pollen-grains.

Fig. 8. Two vanes side by side of the same feather *from the base*, showing another way of carrying pollen-grains.

Fig. 9. One-half of a vane showing thistle-like structure at end of a feather, also showing another method of carrying the pollen-grains between two barbs. Pollen adheres to these feathers by aid of the sticky secretion of plants.